



6. Analysis #1~ MEP Commissioning Process

6.1. What is Commissioning?

Commissioning is a systematic process of ensuring , verifying and documenting that a building facilities and systems performs in accordance with the design intent, contract documents, and the owner’s operational needs. Commissioning is a quality-assurance process that is performed to increase the performance and likelihood that a newly constructed building and its systems meet the clients/owners expectations and needs.

6.2. Types of Commissioning:

Commissioning is the term used for the Cx of a new building.

Re-Commissioning is the term used for Cx of a building that has been previously been commissioned.

Retro-Commissioning is the term used for an existing building that has never previously been commissioned.

6.3. Why Owners Need Building Commissioning (Benefits of):

There are numerous benefits to Commissioning which are, but are not limited to:

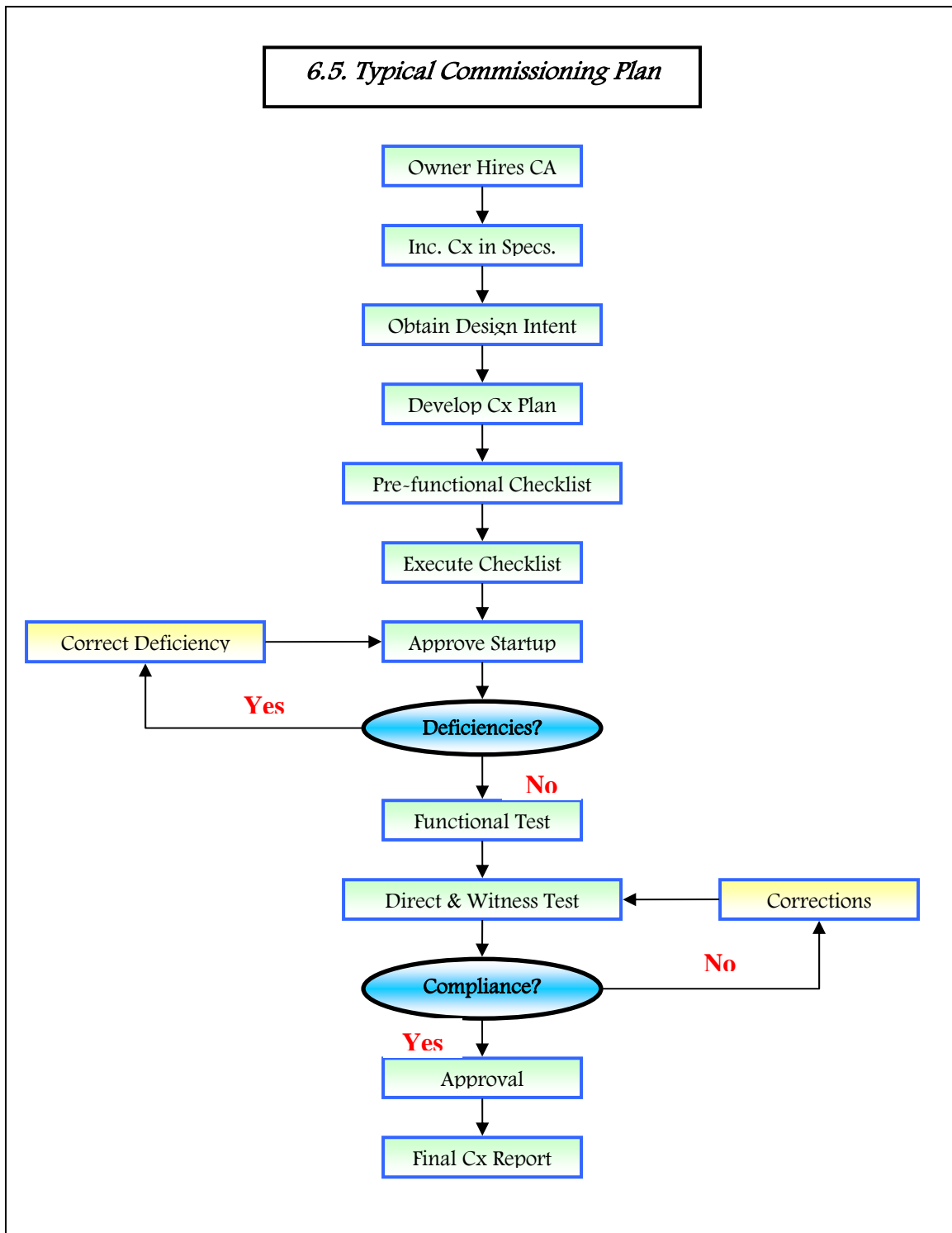
- Maintain Construction Budget
 - Reduced change orders
 - Fewer cost overruns
- Insure the building will meet the Owners Design Intent
- Less contractor call-backs
 - Tests and verifies system which helps identifies future problems in the field.
 - Contractors are still available and on site
 - Helps clarify and determine the appropriate course of action to take in order for proper MEP performance
- Provide Interdisciplinary Coordination between the Design Team, Contractors and Owners.
- Reduction in insurance claims. “Most insurance claims have to do with the integrity of the buildings envelope-wall and roof leaks” David Reid Senior VP and construction industry practice leader for national insurer, Marsh USA Inc.
- Prevents and resolves problems during the early stages of a project when cast are lower in additional cost to the owner



- Shortens project duration
 - Expedites and clarify RFI's
 - Reviews design documents and specifications to perform them right the first time
 - Validates that the building systems perform as designed and specified
 - Can support its designed usage/intent
- Improve the buildings design and functionality
 - Lower energy bills and reduced energy consumption
 - Improved indoor air quality and occupant comfort
 - Improved systems and equipment functions
 - Reduced energy and operations and maintenance costs
 - Proper operations
 - Maintenance training
 - Improved IAQ
 - Occupant comfort and productivity
 - Prevent inaccessibility of mechanical equipment
 - Allows equipment accessibility for maintenance
- Long term tenant/owner satisfaction
- Complete project documentation
- Reduction in project delays
- Additional and easily obtainable LEED points
- Avoided costly equipment replacement/repairs
 - Reduces warrant and replacement and repair costs

6.4. Basic Commissioning Process:

- Design Intent
- Basis of Design
- Develop Commissioning plan
- Design reviews
- Incorporate commissioning into the specifications
- Develop Pre-functional checklist
- Construction review, coordination and inspection
- Schedule testing
- Perform test for system acceptance
 - Testing and verification
- Operations and Maintenance manuals
- System and building training
- Commissioning Report
- Warranty Review





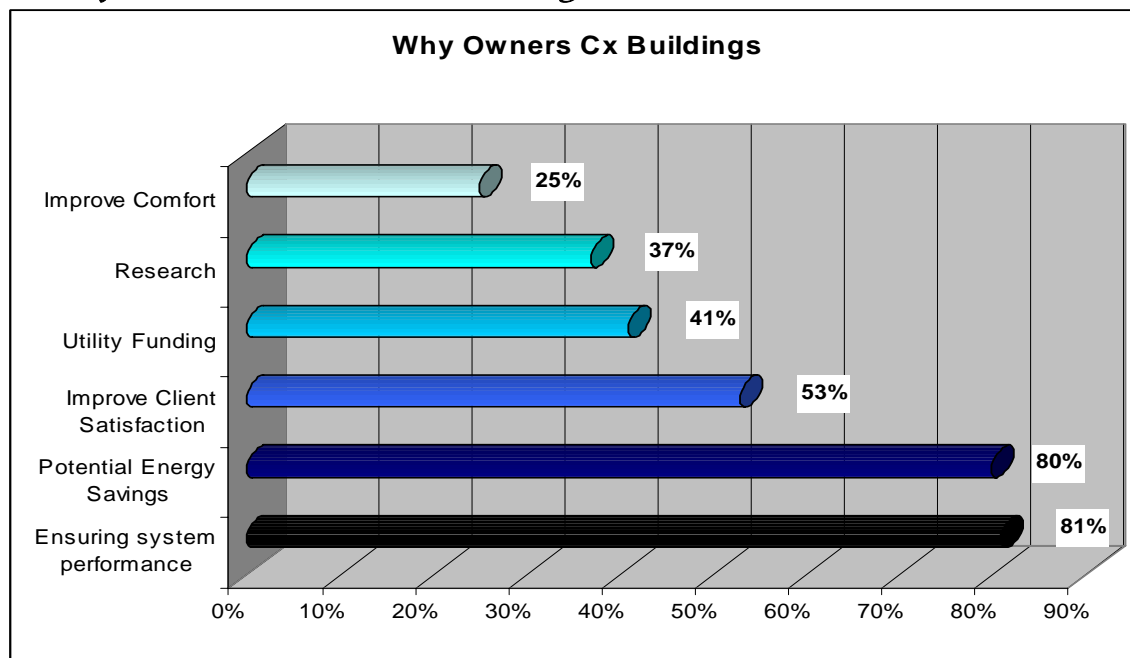
6.6 Deficiencies Found in Non-Commissioned Buildings:

- Incorrect cooling and heating sequence of operation
- Incorrect calibration of sensors and instrumentation
- Disables systems and equipment
- IAQ issues
- Under-utilized computer based control systems
- Premature failure of HVAC equipment due to short cycling
- Malfunctioning air and water side economizer cycles
- Dirty filters and coils
 - Efficiency
- Lack of building documentation
- Missing or unspecified equipment
- Lack of training for building operators

6.7 Cost Saving from Building Commissioning:

- Energy savings from 20 to 50 percent (\$0.50 to \$1.25 per sq. ft.)
- Maintenance savings of 15 to 35 percent, typical.
- Reduced Claims of 2 to 10 percent
- Lower maintenance costs due to properly operating MEP equipment
- Elimination of additional overtime costs due to project deficiencies

6.8 Why owners Commission their buildings:



*To ensure optimum system performance and the potential energy savings from doing so, is the main reason why owners are willing to commission their buildings as per a survey of owners who have commissioned their buildings since 1994.



6.9 Typical Cost Saving per Building Type/Usage:

Building Type	Cx Cost	Annual Savings	Simple Payback (yrs.)
Facility Offices	\$24,000	\$89,760	0.3
High Rise Buildings	\$12,745	\$8,150	1.6
Medical Institutions	\$24,770	\$65,535	0.4
Retail	\$12,800	\$8,050	1.6

*Average Commissioning costs and savings along with payback based upon the most commonly Commissioned building types.

Commissioning historically has had a cost saving of 8-20% over non-commissioned buildings. General costs of commissioning are relatively cheap, on the magnitude of 0.5- 1.5 % of the construction cost, which is a bargain in any owner’s book given the added benefits listed above. MEP Commissioning is the focus, understandably, of numerous owners as it is one of the most complex and expensive systems in a building and is required to perform properly day in and day out for the life of the building. MEP Commissioning can include numerous subsystems.

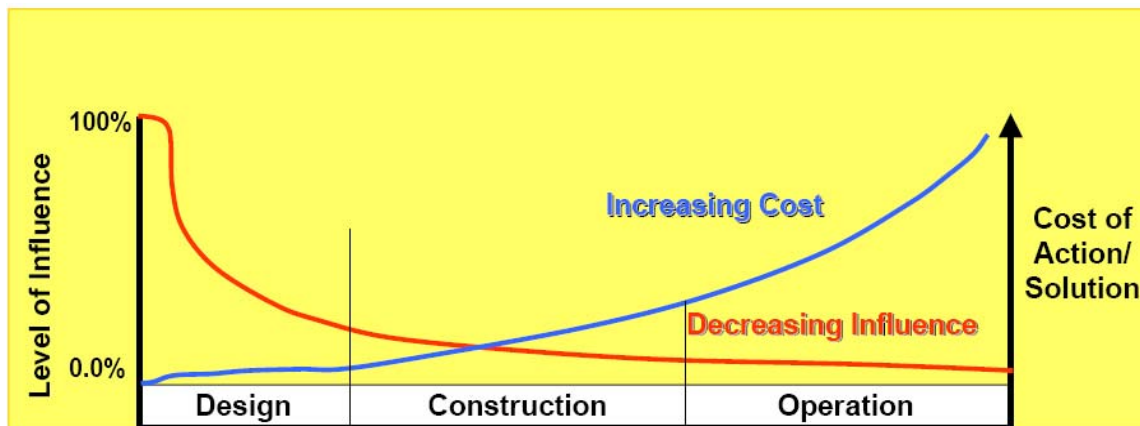
The "Iceberg Theory" recognizes national benchmarks which state only 20% of the building cost over the life of the building is in first cost. The other 80% is in the operation, maintenance, and rejuvenation costs of managing a facility over its lifetime Champaign. It is easy to see how a detailed MEP Commissioning Plan can save a project time and money. With all the added benefits and low cost of commissioning it is difficult to understand why it is not used more often.



The charts below illustrate the cost per scope of commissioning a newly constructed building and the level of influence in relationship to the buildings design, construction and operations costs.

Commissioning Scope	\$ Cost \$
Entire Building (HVAC, Controls, Electrical, Mechanical)	0.5%-1.5% of total construction cost
HVAC and Automated Control System	1.5%-2.5% of mechanical system cost
Electrical Systems	1.0%-1.5% of electrical system cost
Energy Efficiency Measures	\$0.23-\$0.28 per square foot

* Displays the individual average costs associated with Commissioning various scopes and systems with respect to the entire construction cost, system cost, or square footage.



* Shows a direct relationship between level of influence associated during the design aspect of a project in reference to an increasing cost to fix, replace, and rectify a problem as a projects duration increases over time.

6.10. Process improvement/Recommendations::

What can be done or implemented to increase the effectiveness of the commissioning process?

- Improve Owner awareness
 - Benefits of MEP Commissioning
 - Various Case Studies
- Stream line the Commissioning Process
 - Detailed flow chart, keeping everyone involved
- Additional 17th / 18th CSI Division
 - 17th Being Telecommunications/ Controls
 - Should include Integrated Systems
- Internal vs. External Commissioning
 - CM involvement vs. 3rd party



6.11. Improve Owners Awareness:

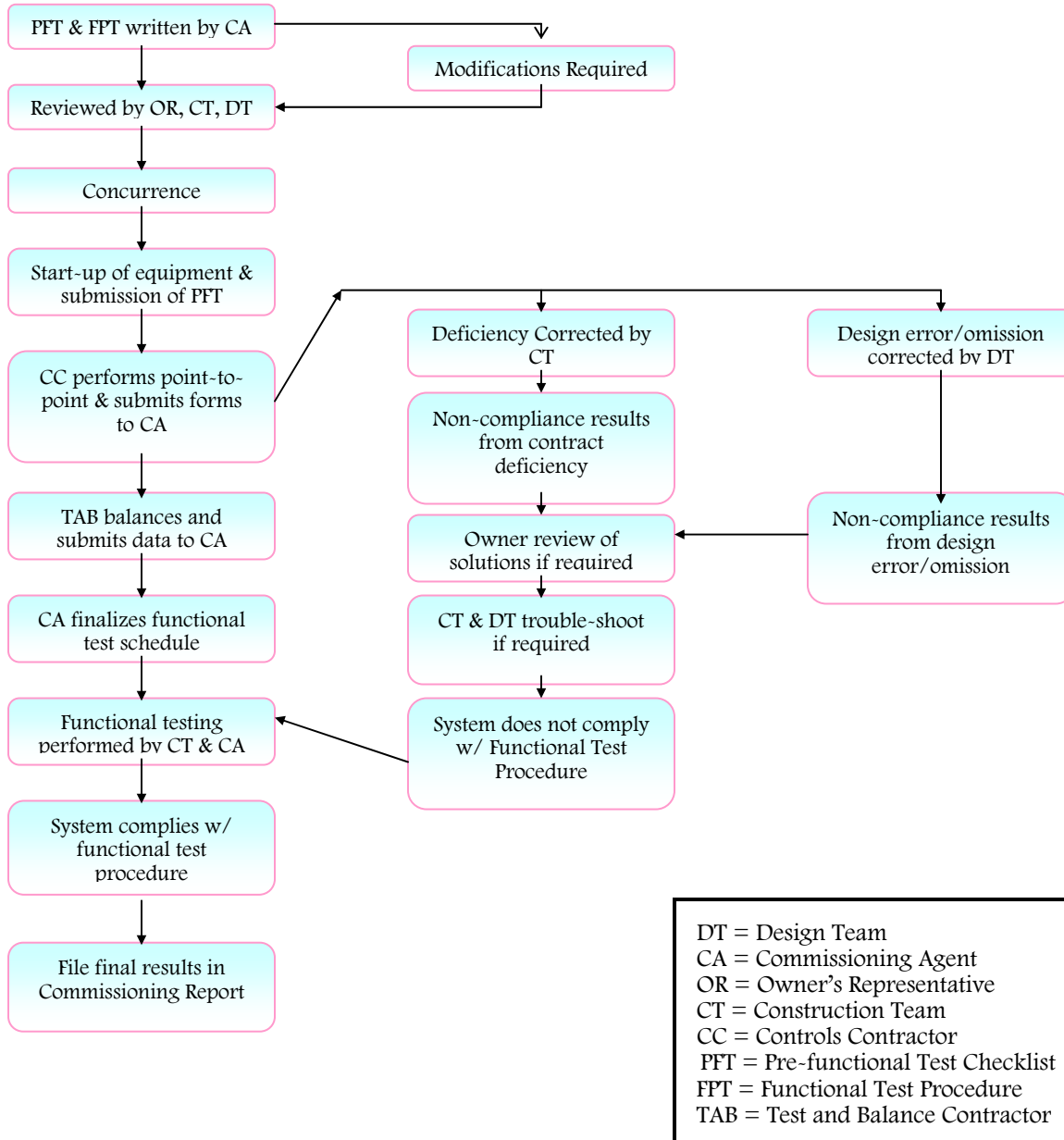
One possible way to make owners more aware of the benefits of the Commissioning process is to provide them with factual evidence, such as the numerous facts and figures stated above. Another possible way is through various case studies providing numerical values of projects gone a miss and the possible saving that can be had by using a detailed commissioning plan.

In each of these following cases the issues could have been solved during the design phase. Changes could have been placed in order to prevent these failures or flaws and would have not had a impact to the schedule or cost of the construction projects. The bottom line is that if a Commissioning plan was in place, all of these problems would have been solved beforehand.

- Walt Disney Caribbean Beach Resort, Florida
 - \$5.5 Million in problems with HVAC and Building Envelope
- Hale Koa Hotel, Hawaii
 - \$ 6.5 Million dollar repair, moisture and mildew. Simple HVAC Fix
- Martin County Courthouse, Florida
 - \$ 16 Million plus, which was more than the building original construction cost alone
- Omni Hotel, South Carolina
 - \$ 11 Million dollar fix, issues with HVAC and building envelope



6.12. Detailed 3rd MEP Commissioning Flow Chart:



*A developed and detailed flow chart can help keep everyone be informed and aware of various scopes of work that need to be performed as a group so that a building can be Commissioned correctly and as efficiently as possible.

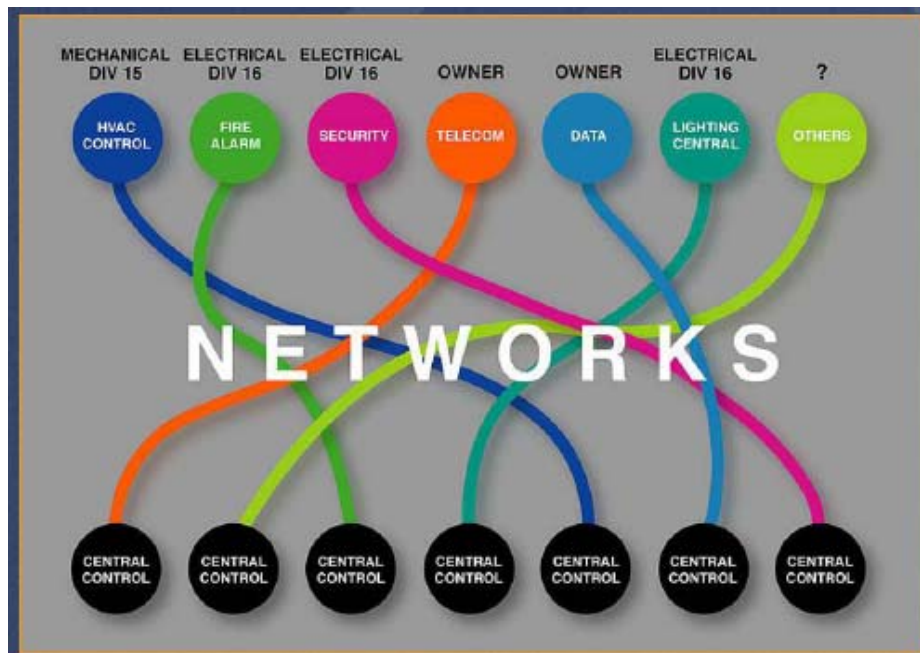


6.13. Additional CSI Division:

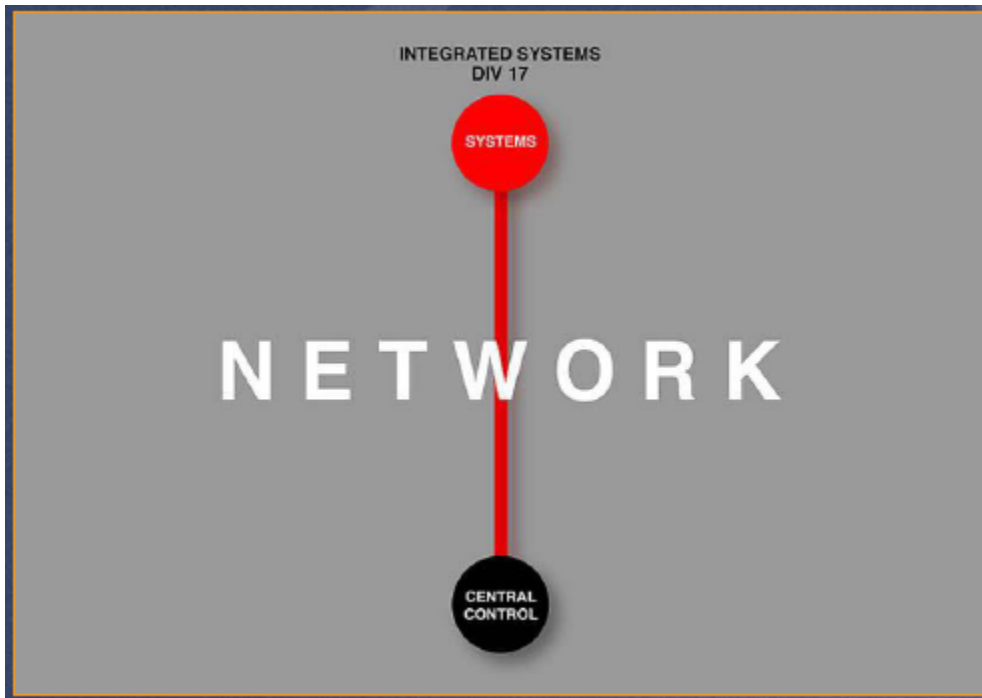
With the new advent of “smart building”, a building scope of work has been ever changing and expanding with technology. Systems are becoming more and more complex, to install, test, balance, ensure, and manage. CSI Divisions will also need to adapt to the changing market. We have started to see this as a 17th division is now being dedicated to telecommunications and a building controls should also include Integrating Systems (IS), making the prime contractor responsible for;

- Provide the installation of all low voltage, and network driven systems such as fire alarms, security, and various process systems.
- Providing the test engineer with responsibility for functional performance testing, i.e. commissioning
- Provide the test start and balance for all MEP systems

With the current CSI Master format, Networking can become a little confusing. Assigning responsibility for various problems and fixes of numerous networks is, well, becoming very complicated.



Vs.



Advantages of Integrated Systems:

- Construction Quality
 - The IS Contractor will have direct contract responsibility and will be selected based on competency in providing and efficiently installing low voltage network driven systems.
 - One IS Contractor will ensure cohesion and organization between prime contractors as well as consistency with various manufacturers' systems.
- Optimum Operational Performance
 - IS contractor will own all work with respect to network, controls and operation systems and will be held liable for ensuring that all systems are tested, adjusted, balanced, and commissioned. As a result this will help achieve the most efficiently integrated and functioning results.
- MEP Construction Quality
 - Typical MEP prime contractors can return their core focus to installing their equipment, pipe, wire, conduit, and ductwork, and not be bothered by issues concerning networking and integration.
- Schedule
 - The IS Contractor will be the single point of contact for all technology and operational issues for the construction team as well as the owner and his representatives.
 - A single test engineer will be available, thereby increasing the project team's ability to manage schedules and perform start up and the commissioning process more efficiently.



6.14. Benefits of Internal/In-House Commissioning:

Among the typical benefits of Commissioning, a new market trend is now moving toward CM In-house commissioning, which in turn has additional benefits such as:

- Qualified to gain additional LEED point for various commissioning processes
- In-depth knowledge of managerial skills and tactics
- Ability to provide various services on all type of facility types and systems
- Familiarity with construction CPM schedules
- Vast/Imperishable experience with in the construction industry and its composition

All the recommendations and the commissioning process in general is a great way to take a small initial investment and gain a return on that investment that is immeasurable. Commissioning when done correctly by qualified individuals is a priceless commodity that should be seriously considered by all owners when constructing, renovating, or updating a facility. The recommendations only seem to strength the progression of Commissioning and add beneficial features that can streamline the process making it more efficient and effective.